Pandemic Influenza
Overview

Outline

- What is influenza?
- What is an influenza pandemic?
- History of influenza pandemics
- Control measures

CDC

Influenza

- **Respiratory infection**
- **Transmission:** contact with respiratory secretions from an infected person who is coughing and sneezing
- **Incubation period:** 1 to 5 days from exposure to onset of symptoms
- **Communicability:** Maximum 1-2 days before to 4-5 days after onset of symptoms
- **Timing:** Peak usually occurs December through March in North America

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Influenza Symptoms

- Rapid onset of:
  - Fever
  - Chills
  - Body aches
  - Sore throat
  - Non-productive cough
  - Runny nose
  - Headache

Influenza is a serious illness

- Annual deaths: 36,000*
- Hospitalizations: >200,000*

* Average annual estimates during the 1990's

- Who is at greatest risk for serious complications?
  - **persons 65 and older**
  - **persons with chronic diseases**
  - **infants**
  - **pregnant women**
  - **nursing home residents**

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Influenza Types

- Type A
  - Epidemics and pandemics
  - Animals and humans
  - All ages
- Type B
  - Milder epidemics
  - Humans only
  - Primarily affects children

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Influenza Antigenic Changes

Structure of hemagglutinin (H) and neuraminidase (N) periodically change:

- **Drift: Minor change, same subtype**
  - In 1997, A/Wuhan/359/95 (H3N2) virus was dominant
  - A/Sydney/5/97 (H3N2) appeared in late 1997 and became the dominant virus in 1998

- **Shift: Major change, <u>new</u> subtype**
  - H2N2 circulated in 1957-67
  - H3N2 appeared in 1968 and replaced H2N2
  - **Pandemic potential**

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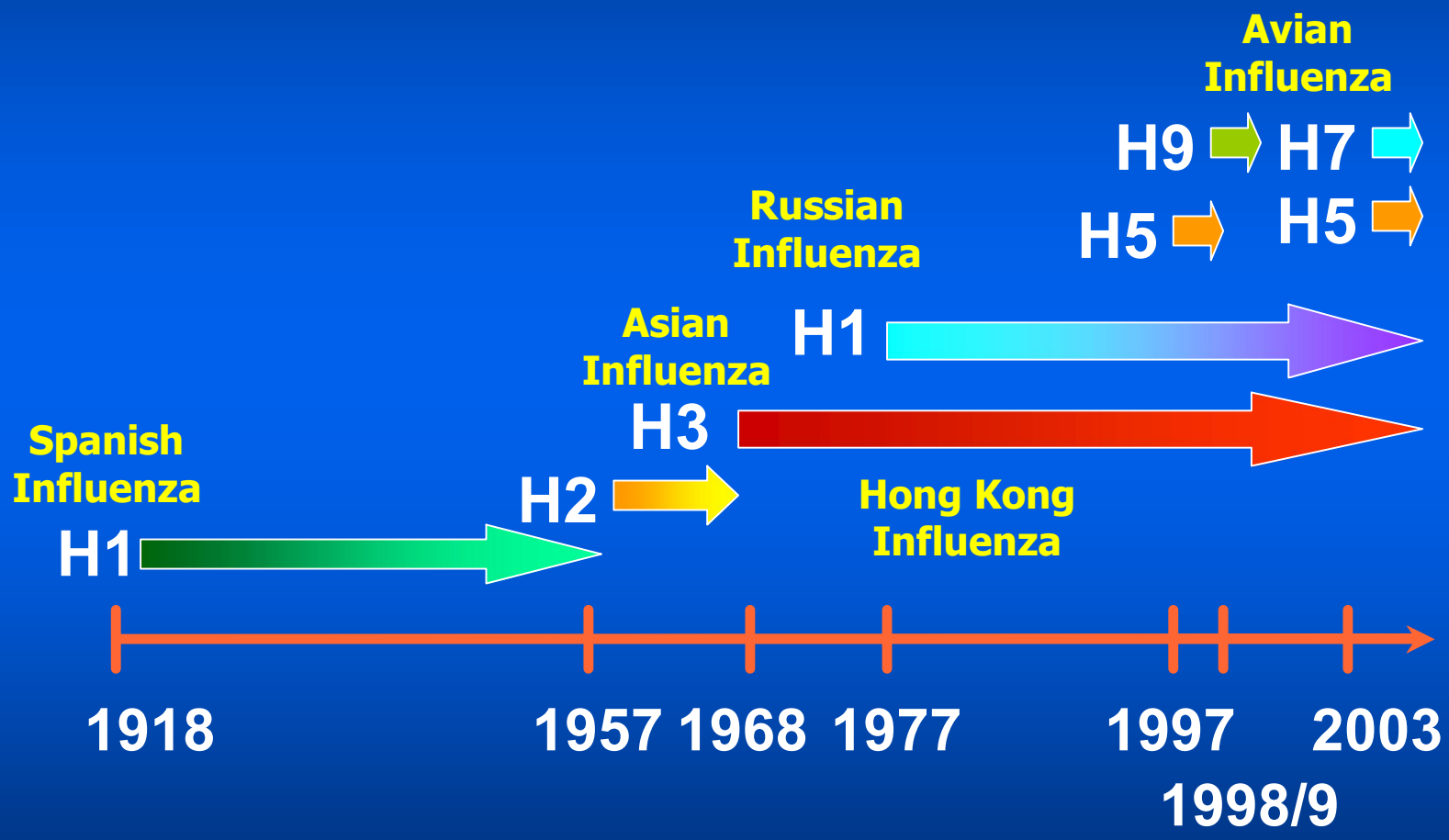
Timeline of Emergence of Influenza A Viruses in Humans



Pandemic influenza: definition

- Global outbreak with:
  - Novel virus, all or most susceptible
  - Transmissible from person to person
  - Wide geographic spread

Impact of Past Influenza Pandemics/Antigenic Shifts

Pandemic, or Antigenic Shift	Excess Mortality	Populations Affected
1918-19 (A/H1N1)	500,000	Persons <65 years
1957-58 (A/H2N2)	70,000	Infants, elderly
1968-69 (A/H3N2)	36,000	Infants, elderly
1977-78 (A/H1N1)	8,300	Young (persons <20)

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Pandemic influenza: 2nd waves

- 1957: second wave began 3 months after peak of the first wave
- 1968: second wave began 12 months after peak of the first wave

Next pandemic: impact

Attack rate ranging from 15% to 35%:

- Deaths: 89,000 - 207,000
- Hospitalizations: 314,000 - 733,000

Source: Meltzer et al. EID 1999;5:659-71

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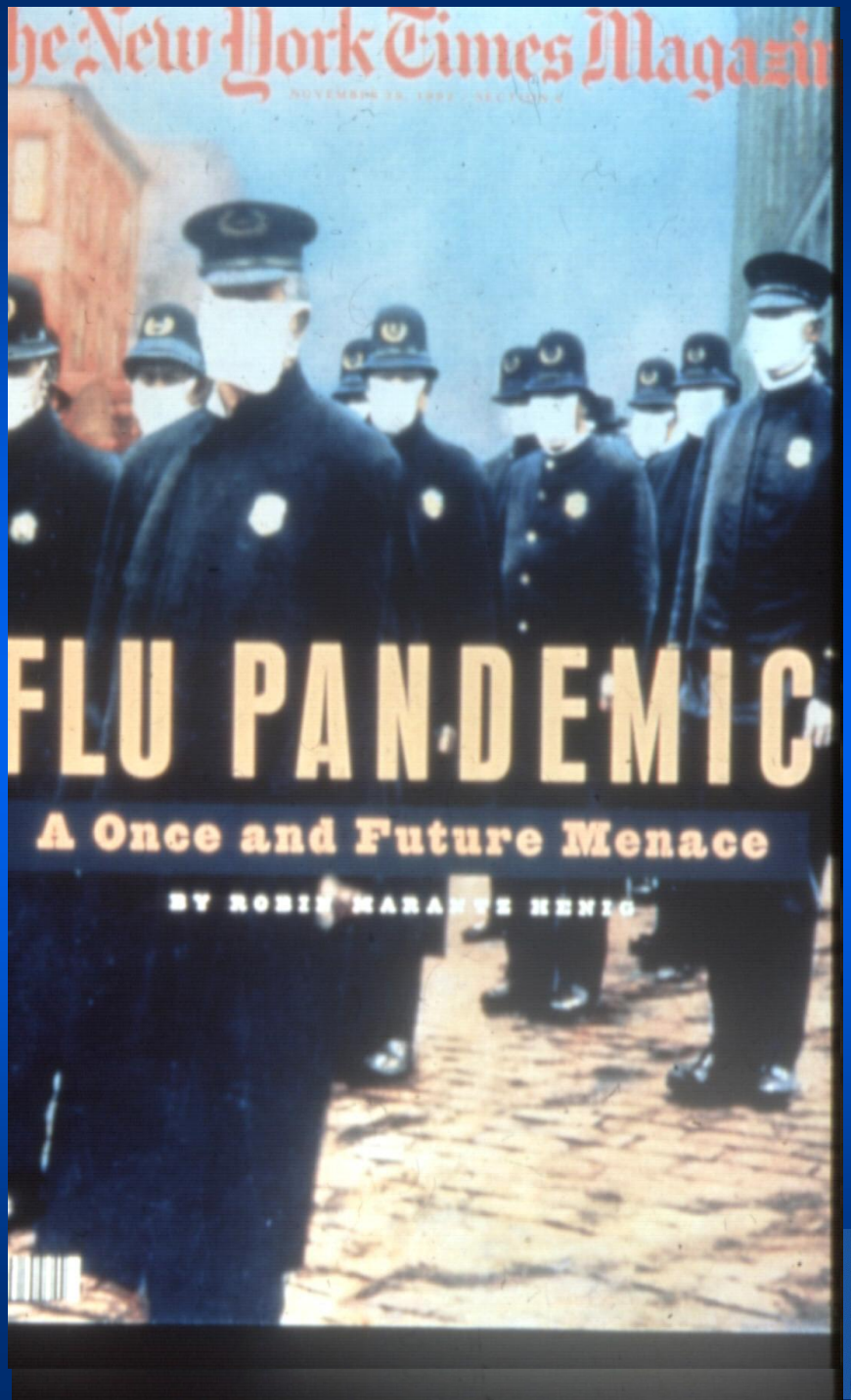
The 1918 Influenza Pandemic



America's Forgotten Pandemic

by Alfred Crosby

"The social and medical importance of the 1918-1919 influenza pandemic cannot be overemphasized. It is generally believed that about half of the 2 billion people living on earth in 1918 became infected. At least 20 million people died. In the Unites states, 20 million flu cases were counted and about half a million people died. It is impossible to imagine the social misery and dislocation implicit in these dry statistics."

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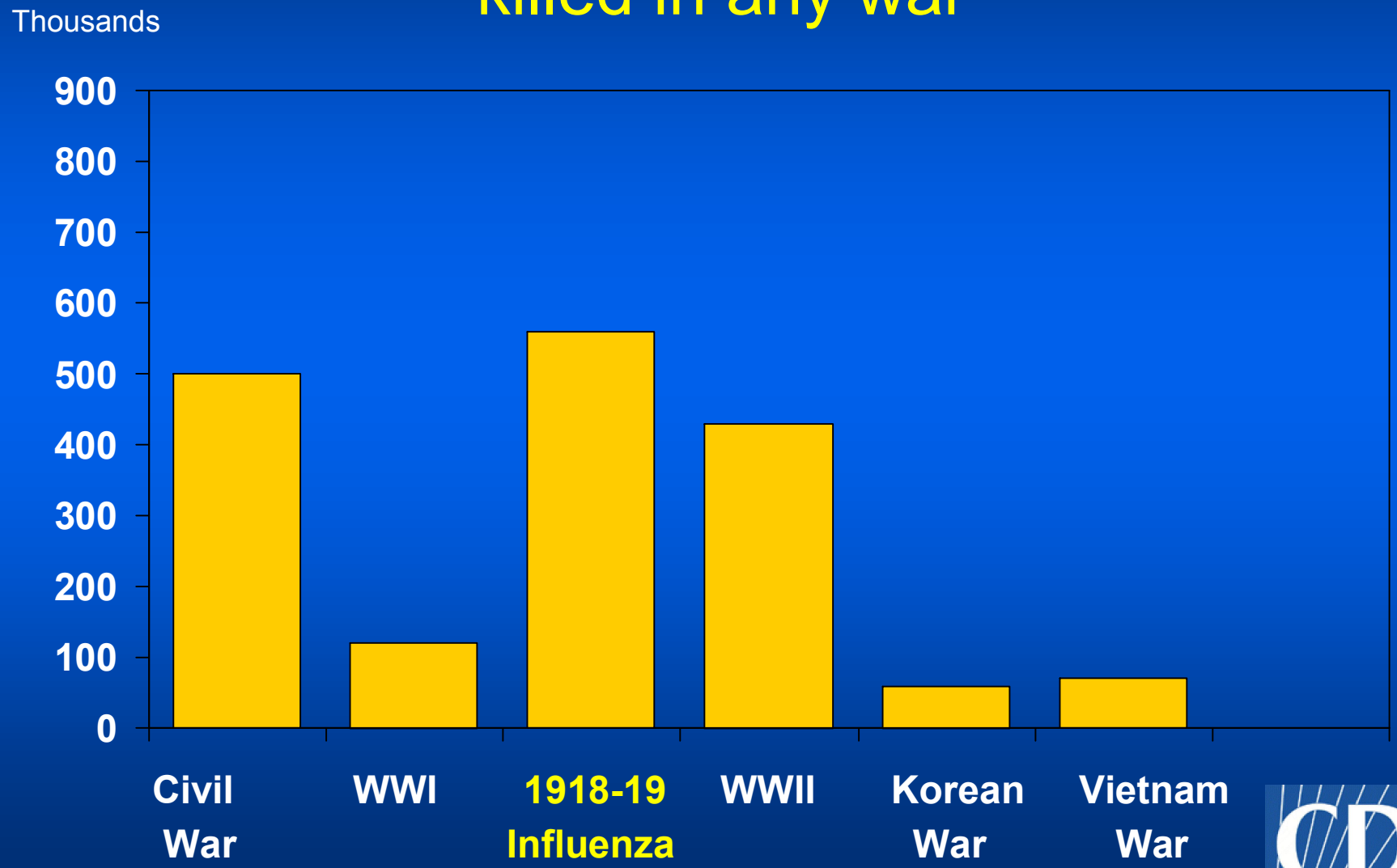
America's deaths from influenza were greater than the number of U.S. servicemen killed in any war



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Spanish Influenza

- Slowed to a trickle the delivery of American troops on the Western front.
- 43,000 deaths in US armed forces.
- Slow down and eventual failure of the last German offensive (spring and summer 1918) attributed to influenza.

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Pneumonia and Influenza Mortality by Age in Certain Epidemic Years

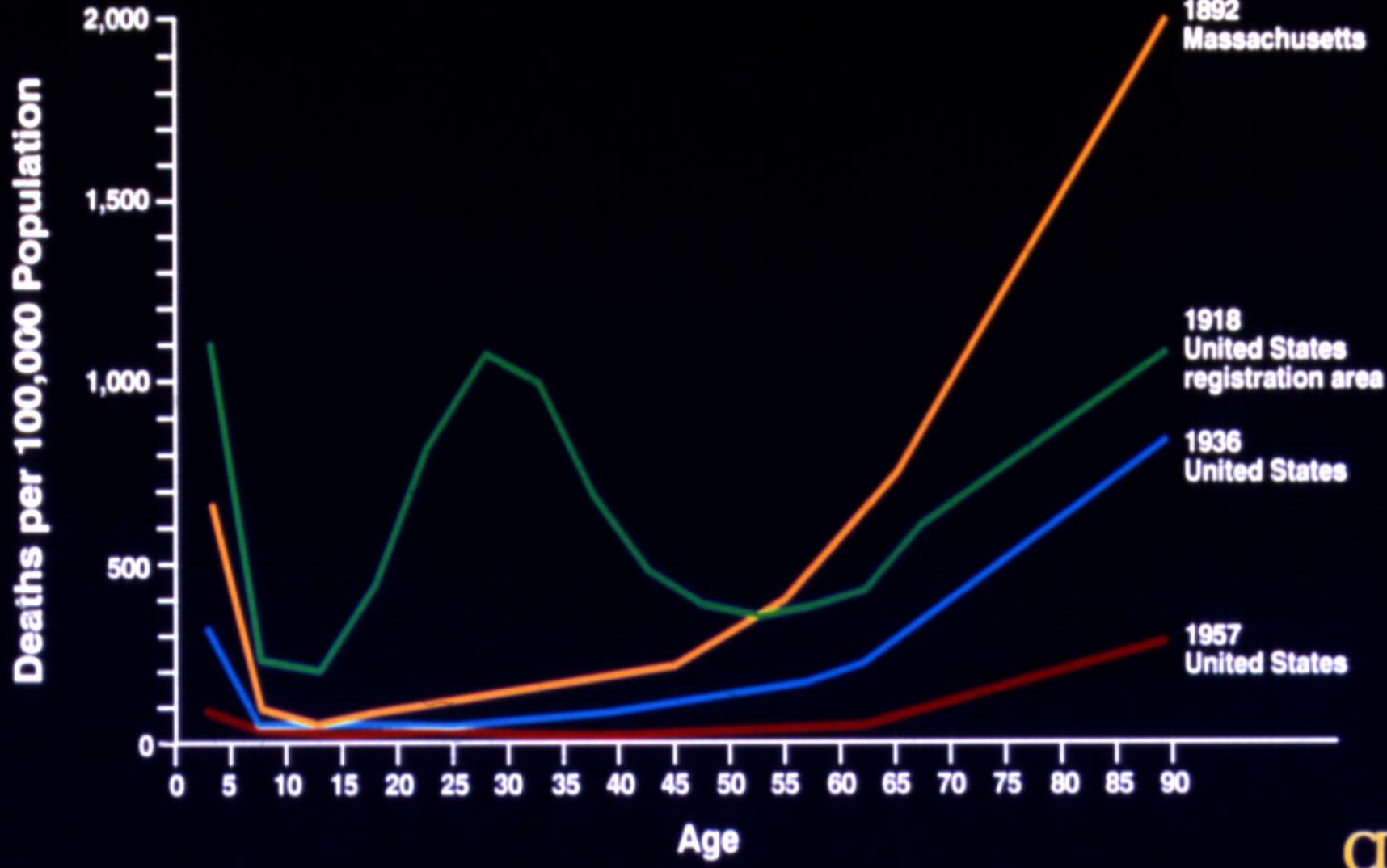
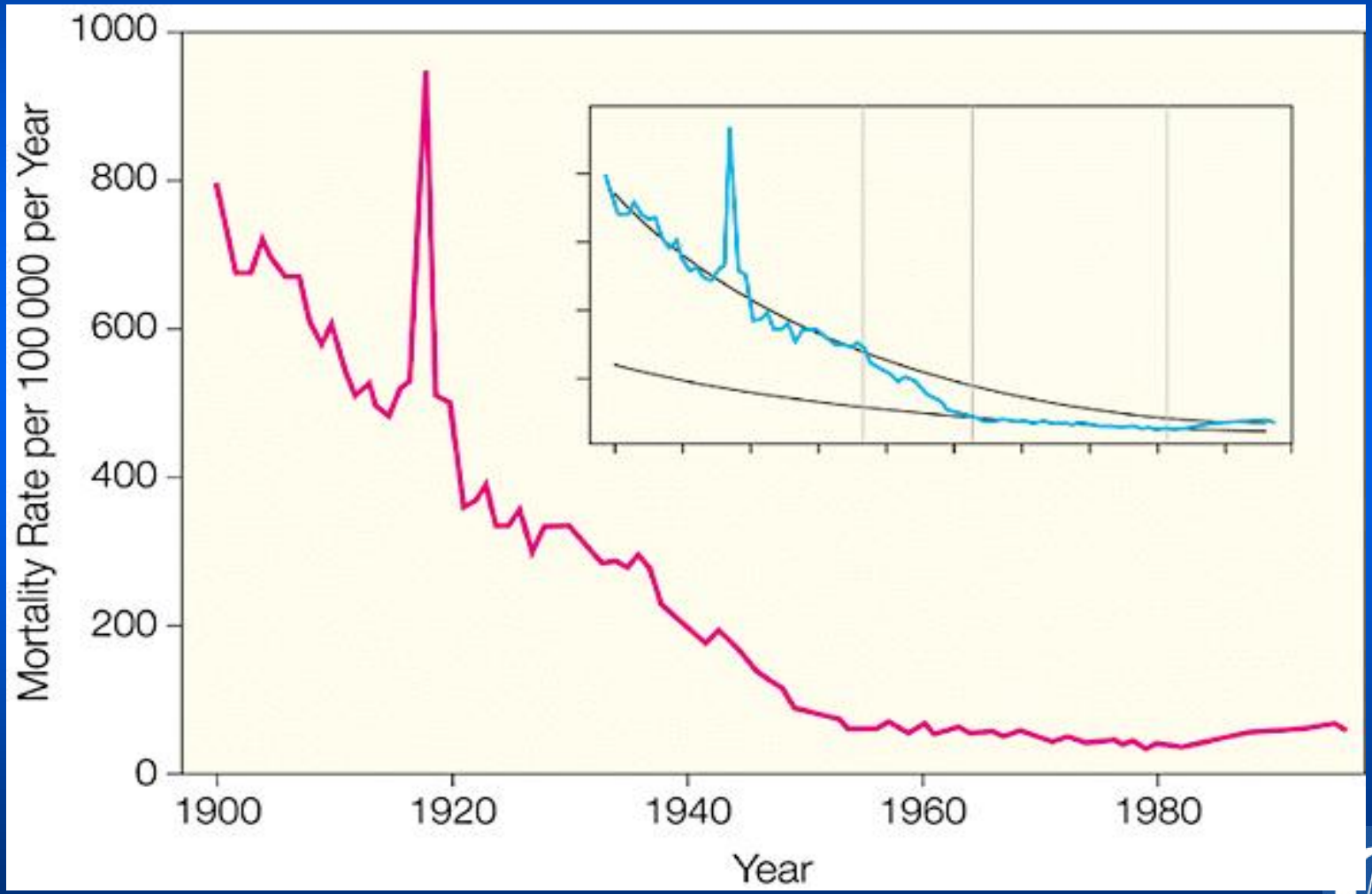



Photo: The American Red Cross

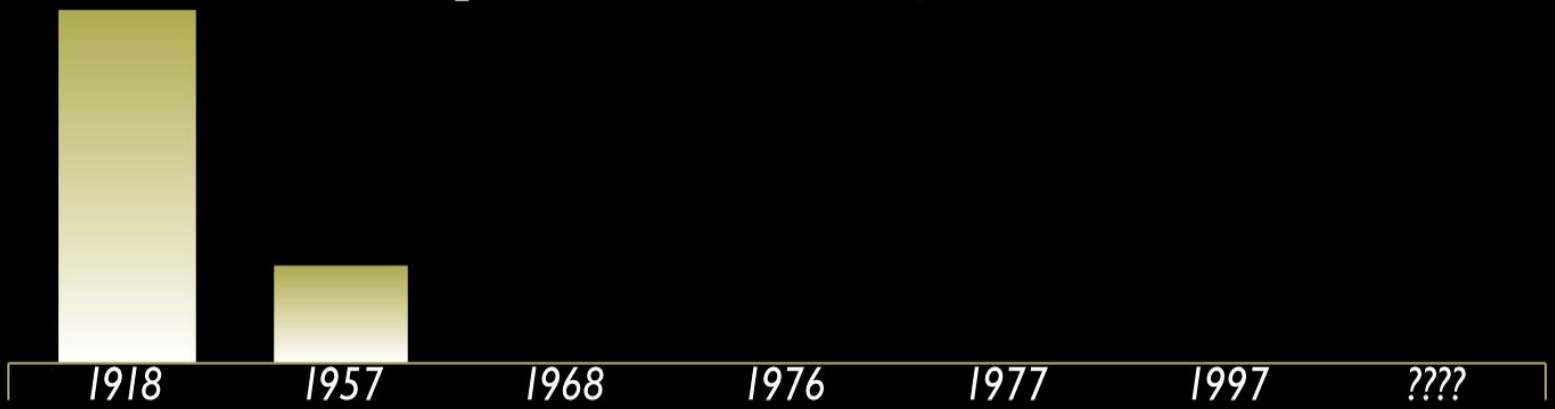
Infectious Disease Mortality, United States--20th Century



Armstrong, et al. *JAMA* 1999;281:61-66.

1957 Asian Flu
H2N2

- Originated in Far East in Feb 1957
- Vaccine production began early May
  - Available in limited supply in Aug
- "Double Wave" of illness/death
  - 1st peak Oct 1957; 2nd peak Jan/Feb 1958
- Number of deaths in U.S.: 69,800
  (Sept 1957-March 1958)



Worldwide Spread in 6 Months

Spread of H2N2 Influenza in 1957

"Asian Flu"

69,800 deaths (U.S.)

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“Asian Flu” Timeline

February 1957
- Outbreak in Guizhou Province, China

April-May 1957
- Worldwide alert
- Vaccine production begins

October 1957
- Peak epidemic, follows school openings

December 1957
- 34 million vaccine doses delivered
- Much vaccine unused

January-February 1958
- Second wave (mostly elderly)

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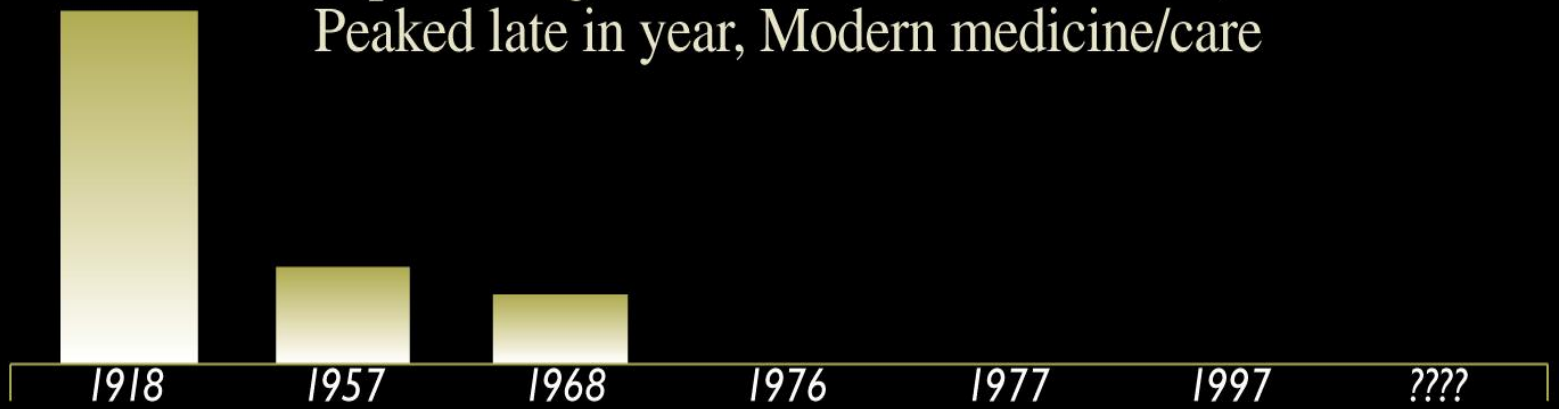
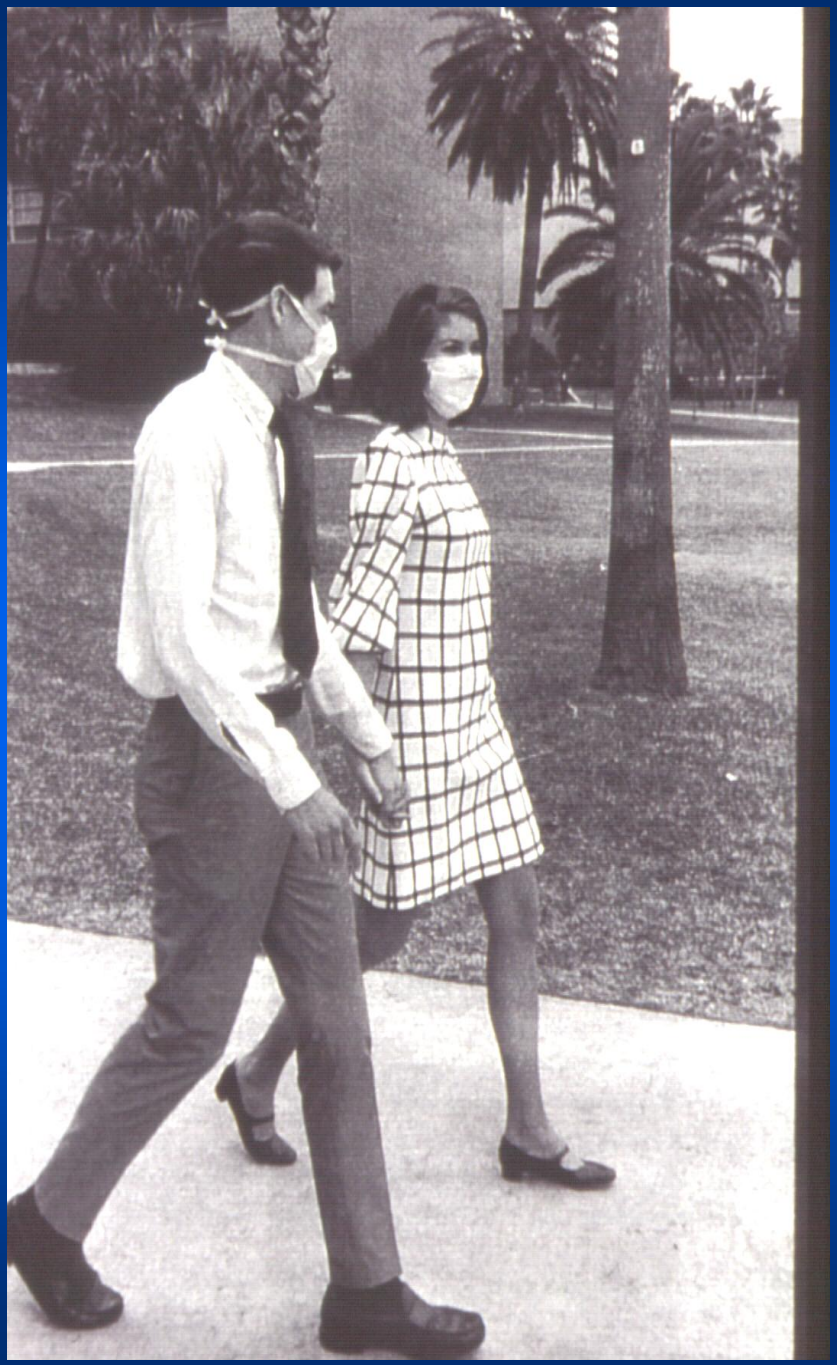
1968 Hong Kong Flu
H3N2

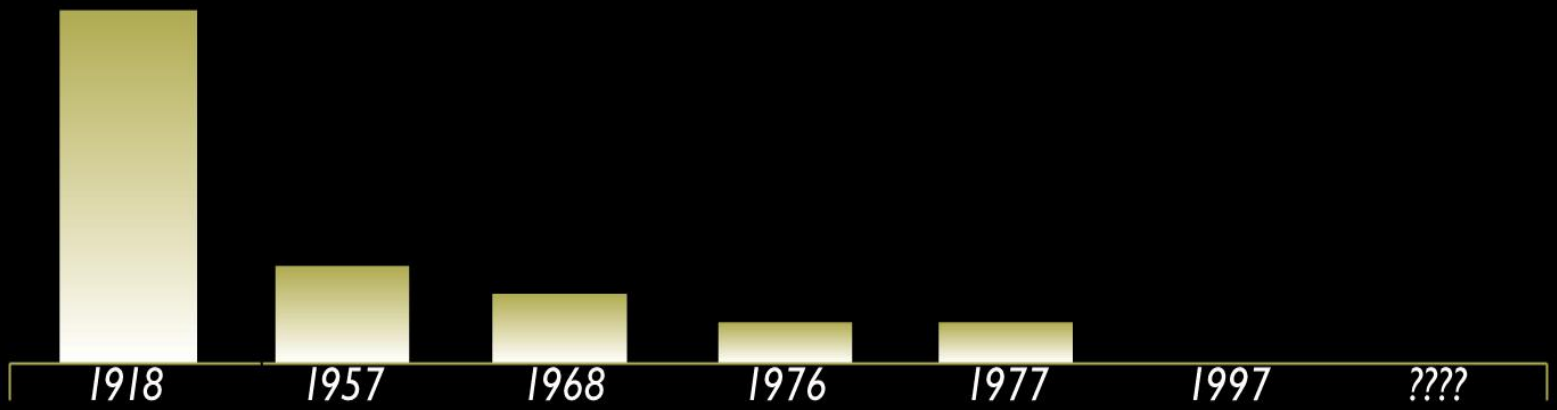
- Four year wave
  - Illness widespread Dec 1968
  - Same virus returned following 3 flu seasons
- Elderly most vulnerable
- Number of deaths in U.S.: 33,800
  (Sept 1968-March 1969)
- Impact mitigated: Similar to 57 Asian flu,
  Peaked late in year, Modern medicine/care





1977 Russian Flu H1N1

- Virus similar to those circulating from 1947-1957
- Global "epidemic" by Jan 1978
- Persons born before 1957 appeared to have significant immunity
- Mainly affected those <23 years old, illness occurred primarily in children



Close calls: avian influenza transmitted to humans

- 1997: H5N1 in Hong Kong
  18 hospitalizations and 6 deaths
- 1999: H9N2 in Hong Kong
  2 hospitalizations
- 2003:
  - » H5N1 in China
    2 hospitalizations, 1 death
  - » H7N7 in the Netherlands
    80 cases, 1 death
    (eye infections, some resp. symptoms)

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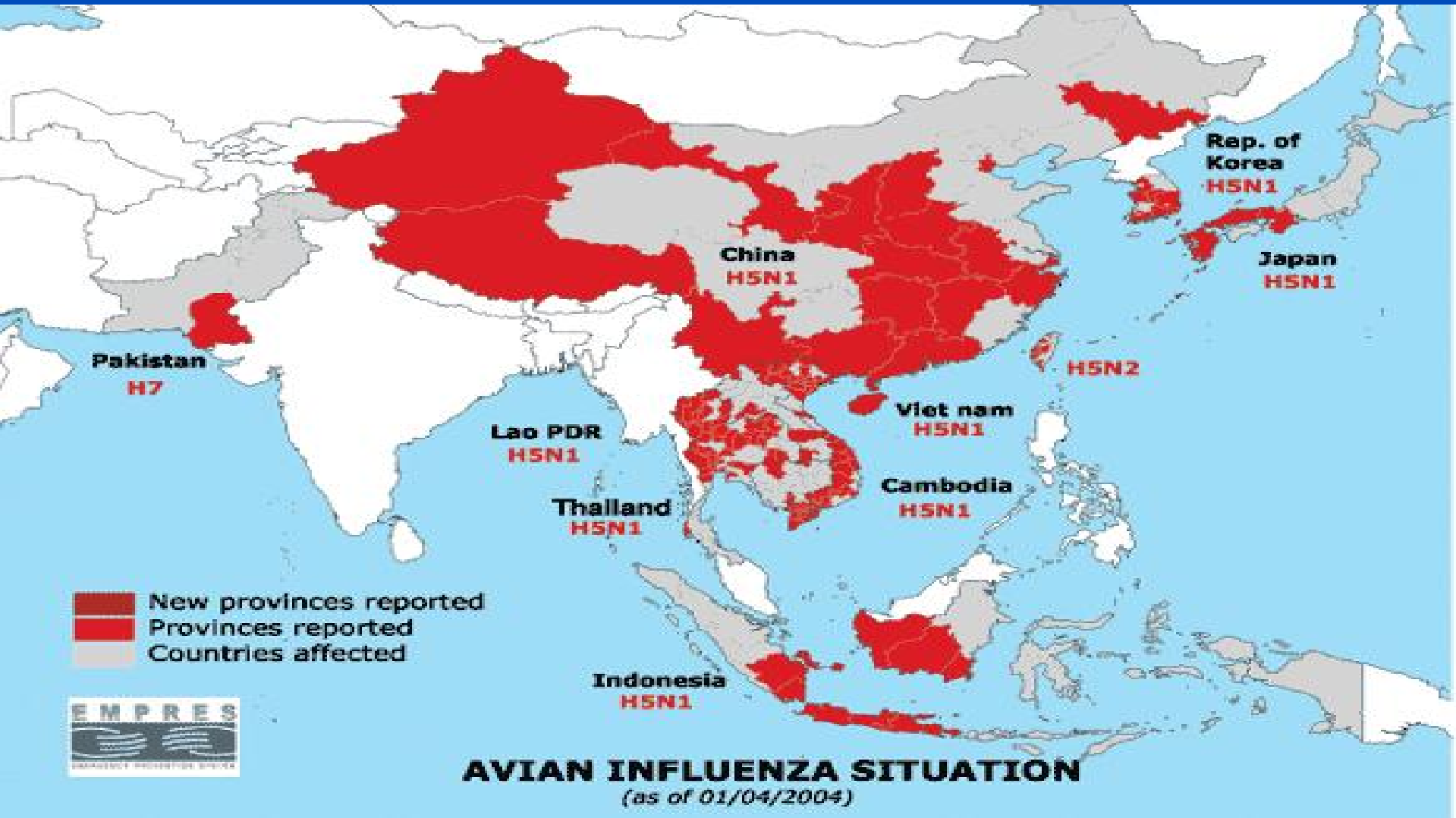
Avian Influenza Poultry Outbreaks, Asia, 2003-04



Avian Influenza Poultry Outbreaks, Asia, 2003-04

- Historically unprecedented scale of outbreak in poultry
- Human cases reported from Vietnam and Thailand (as of 1/21/05: 52 cases; 39 deaths)
- No sustained person-to-person transmission identified
- Duration of the outbreak creates potential for genetic change that could result in person-to-person transmission

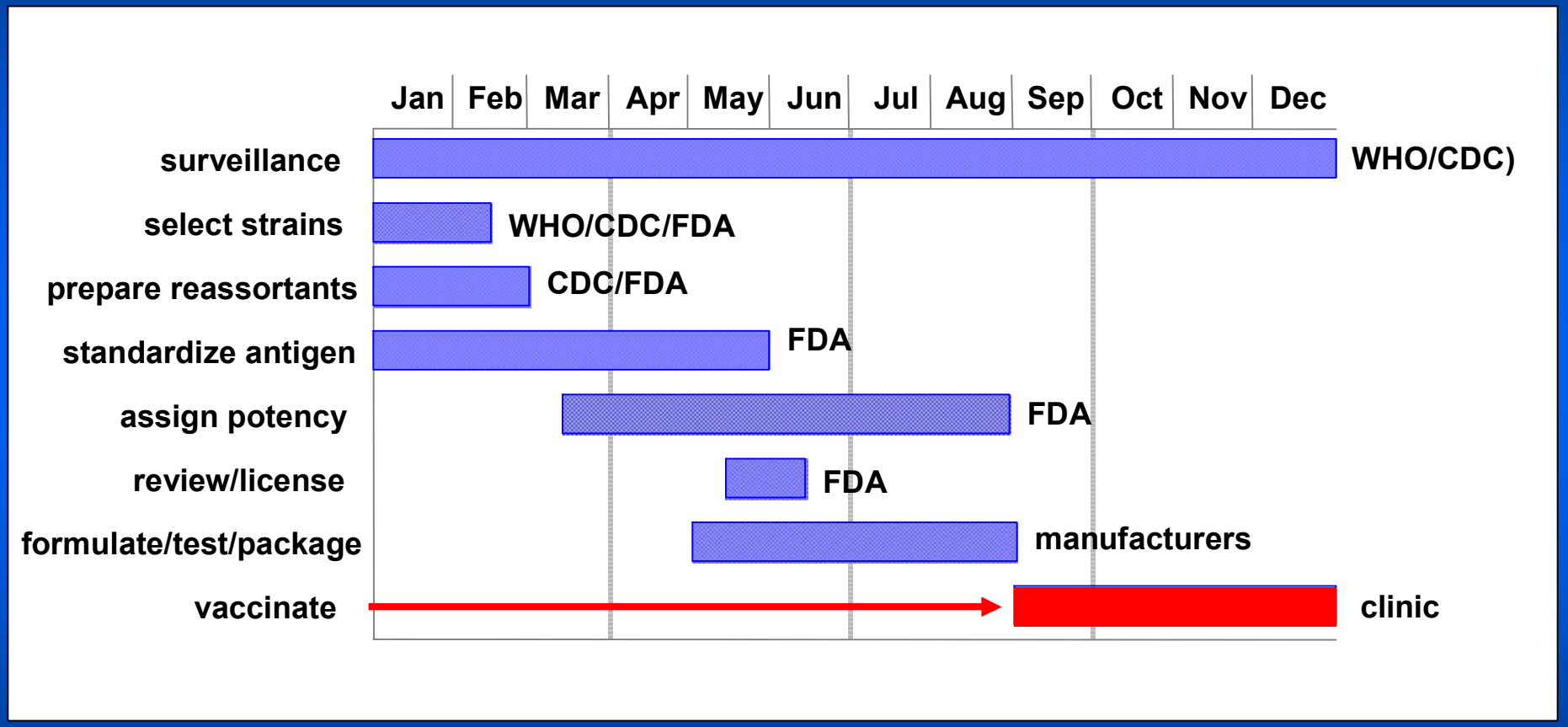
“The pandemic clock is ticking, we just don’t know what time it is”

E. Marcuse

Influenza Control: vaccine

- Cornerstone of prevention
- Annual production cycle ensures availability by late summer/early summer

Vaccine Development



Pandemic Vaccine

- Annual vaccine is trivalent (3 strains), pandemic vaccine will be monovalent.
- Production using current technologies would likely take 4-5 months → may not be available before 1st pandemic wave
- There will be vaccine shortages initially
- 2 doses may be necessary to ensure immunity

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Influenza control: antiviral medications

- Uses
  - Prophylaxis
  - Treatment
- Issues
  - Limited supply
  - Need for prioritization (among risk groups and prophylaxis versus treatment)
  - Unlikely to markedly affect course of pandemic

CDC

Influenza control: infection control

- influenza isolation precautions*
  - Private room or with other influenza patient
  - Negative air pressure room, or placed with other suspected influenza cases in area of hospital with independent air supply
  - Masks for HCW entering room
  - Standard droplet precautions (hand washing, gloves, gown and eye protection)

* 1994 Guidelines for Prevention of Nosocomial Pneumonia

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Infection control, cont'd

- Feasibility of these measures in a pandemic setting is questionable, priorities should include:
  - Droplet transmission precautions (use of masks and hand hygiene)
  - Cohorting of influenza-infected patients

Influenza control: other control measures

- Education to encourage prompt self-diagnosis
- Public health information (risks, risk avoidance, advice on universal hygiene behavior)
- Hand hygiene
- Face masks for symptomatic persons
- School closures (?)
- Deferring travel to involved areas

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Influenza control: quarantine

- Challenges
  - short incubation period for influenza
  - a large proportion of infections are asymptomatic
  - clinical illness from influenza infection is non specific
- Not used during annual epidemics
- Could potentially slow onset of a pandemic before sustained person-to-person transmission has been established

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Medical care during an influenza pandemic

- Surge capacity of the hospital system is limited.
- Challenges:
  - Magnitude and duration
  - Staff shortages
  - Limited ability to call in external resources

Pandemic Flu Today

Despite . . .

- Expanded global and national surveillance
- Better healthcare, medicines, diagnostics
- Greater vaccine manufacturing capacity

New risks:

- Increased global travel and commerce
- Greater population density
- More elderly and immunosuppressed
- More daycare and nursing homes
- *Bioterrorism*

CDC